graph of the actual program to another graph that the program code never in fact executes, but which can is advantageous in profiling the program. Claim 1 clearly recites "replacing" an inner region with a "representative entry node." That is, an entire region of code, possibly having multiple entry nodes, is collapsed into a single one of those entry nodes. In the example of Figs. 2A and 3A, entry nodes C and E of region 210, having paths from outer {prolog) nodes A and B, are replaced by only one of the entry nodes, node C. Claim 13 further recites "adding an edge" from a prolog node to "the representative entry node." The foregoing example adds a path from B to C, a path that does not exist in the actual code, and a path which is not followed in the real program. Muchnick has no such added path. Claim 13 then adds "an edge from the representative entry node to the epilog node" and does so "for each epilog node." In the example, these are paths from C to G and from C to H, which replace the actual paths F to G and D to H, which are the actual paths executed by the program. Again, Muchnick does not add any paths to the paths followed by the program itself. Therefore, the Muchnick paper lacks almost the entirety of claim 1, including the purpose of the method.

The amendments to claim 13 do not narrow its scope. The added first element merely presents the program previously recited in the preamble. "Selecting" replaces "identifying" as a more accurate term; which node is the representative node is arbitrary, not predetermined.

Dependent claims 14-17 incorporate the recitations of their parent claim 13.

Applicant traverses the rejection of dependent claim 14 under 35 U.S.C. §103(a) as unpatentable over Muchnick in view of Ball et al., "Efficient Path Profiling." However the only feature added by the Ball paper is the use of edge sum. Therefore, no combination with Muchnick reaches the recitations of claim 14 that are incorporated from parent claim 13.

Applicant traverses the rejection of dependent claim 17 under 35 U.S.C. §103(a) as unpatentable over Muchnick in view of Adl-Tabatabai (U.S. Patent No. 6,170,083). The only relevant feature added by Adl-Tabatabai is the definition of inner and outer hierarchical regions in a program. Again, no combination with Muchnick reaches the recitations of claim 14 that are incorporated from parent claim 13., and the rejection must fall.

Independent claim 18 also recites patentable differences from Muchnick. Claim 18 selects a path identified by "representative" entry and exit nodes—nodes that represent all of the

entry nodes of the region, and replace them. Claim 18 also recites "adding an edge" to the control graph, an edge that does not exist in the actual code, from a prolog node to the representative entry node. It then recites "adding an edge from the representative exit node to the epilog node," another edge that has no correspondent in the actual graph. Muchnick never departs from the graph of the actual code of the program he analyzes, and therefore has no suggestion of either of such added edges. The amendments to claim 18 do not narrow its scope.

Dependent claims 19-23 incorporate the recitations of parent claim 18. Article claims 24-25 incorporate the method recitations of claims 18 and 19.

Applicant traverses the rejection of dependent claim 22 under 35 U.S.C. §103(a) as unpatentable over Muchnick in view of Adl-Tabatabai (U:S. Patent No. 6,170,083). The only relevant feature added by Adl-Tabatabai is the definition of inner and outer hierarchical regions in a program. Again, no combination with Muchnick reaches the recitations of claim 14 that are incorporated from parent claim 18.

Applicant traverses the rejection of dependent claim 14 under 35 U.S.C. §103(a) as unpatentable over Muchnick in view of Ball et al., "Efficient Path Profiling." However the only feature added by the Ball paper is the use of edge sum. Therefore, no combination with Muchnick reaches the recitations of claim 14 that are incorporated from parent claim 18.

Claims 1-12 and 26-30 were rejected under 35 U.S.C.§103(a) as being unpatentable over Ball et al., "Efficient Path Profiling", in view of Adl-Tabatabai (U.S. Patent No. 6,170,083). Applicant respectfully traverses these rejections, and reserves the right to remove this reference at a later date.

The Ball paper has one purpose only: to introduce an algorithm for assigning edge values to the graph of a computer program to produce a unique sum for every different path through the graph. The purpose of assigning and summing edge values is to provide a unique address into a counter for the particular path that is executed, as one of many methods to track execution frequency of different paths through a program. Ball always presents a program as a single region or section of code. Ball has no suggestion of a hierarchy of program regions, or of embedding any inner portion of the program within any outer portion.

,AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111
Serial Number: 09/541,399
Filing Date: March 31, 2000
Title: HIERARCHICAL SOFTWARE PATH PROFILING

Page 8
Dkt: 884.217US1

The Adl-Tabatabai profiles Java programs. The programs are divided into subregions within regions, for the purpose of deciding when to incrementally compile code for immediate execution. The patent teaches one skilled in the art only one way to implement profile indicators for a region:

> "At the end of the code region, a path profile counter determines which of the possible execution paths was followed. Thus, after each region of code is executed the present invention will know which execution path was followed." (col. 6 lines 15-19)

The patent itself suggests no method for specifying particular counters. The patent itself does not even suggest that the system needs to maintain or initialize any counters when entering or exiting a region, or to keep track of counters for a region while a different region is being executed. The Office action attempts to fill this void in the reference with the pure supposition that:

> "Furthermore, Adl-Tabatabai demonstrated *when entering an inner region, saving an outer path sum* (necessary for hierarchical code regions for returning after computing one nested level down)." Page 7 (emphasis in original)

Such a supposition clearly imputes to Adl-Tabatabai a feature that the reference simply does not teach—that the reference does not even teach a need for.

Accordingly even an improper combination of Ball and Adl-Tabatabai does not reach the recitations in claim 1 for "saving an outer path sum," for "initializing an inner path sum," or for "restoring the outer path sum." Ball has only a single sum, and need not do anything with it. Adl-Tabatabai has no sums at all, and does not disclose what, if anything, happens to his profile counters upon region entry or exit.

The amendments to claim 1 do not narrow its scope. The "hierarchical software path" is merely imported from the shortened preamble. Substituting "after" for "when" broadens the period of time during which the named operations may occur.

Dependent claims 2-12 incorporate the recitations of their parent claim 1, and add other distinguishing features as well. For example, claim 2 particularizes initializing the inner path sum to "a value corresponding to an edge from a region source node to an entry node of the inner region." The Office Action merely supposes this to be the way that Adl-Tabatabai would perform such an operation, if Adl-Tabatabai had such an operation. Claim 5 initializes the inner sum to a value "corresponding to an edge from a function entry to an entry node of the inner

region." Again the Office Action first supposes that Adl-Tabatabai might possibly employ edge

sums, and that, if he did so, he might initialize them to a value of a type of node that he does not

disclose. As a further example, claim 10 recites that the inner sums of an inner region are

"unique relative to inner path sums corresponding to other inner regions." The Office Action

declares thast "without this uniqueness profiling would have little use." Yet Applicant's system

uses this feature only for global-based profiling, and need not employ it for region-based

profiling.

Independent claim 26 distinguishes from any combination, even an improper one, of the

Ball paper and the Tabatabai patent, for substantially the same reasons as does claim 1. Neither

reference saves "an outer path sum. Neither reference increments a counter as a function of an

"inner path" sum. The amendments to claim 26 do not narrow its scope. Dependent claim 27

restores "the outer path sum," an operation not found in either of the references. Claim 28

applies the method to "each of a plurality of inner regions," a concept not suggested in Ball.

Claims 29 and 30 reiterate the method elements of claims 26 and 27 in the context of article

claims to a medium.

New independent claim 31 also distinguishes in a patentable manner from any

combination of the Ball and Adl-Tabatabai references by accumulating both inner and outer sums

and saving and restoring the outer sum. In addition, claim 31 assigns the outer edge values for

outer-region paths in which "the inner region is treated as a single node, as described on page 6

lines 11-14 of the Specification. No inference from the references attains this recitation. New

dependent claims 32-39 add further features. For example, claims 37 and 38 push and pop the

outer sum in a stack, a mechanism not suggested by either reference.

Conclusion

Applicant urges that the claims are in condition for allowance and requests reexamination under 35 U.S.C. §132 and notification to that effect. The Examiner is invited to telephone Applicant's attorney at (612) 373-6971 to facilitate prosecution of this Application.
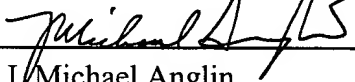
Applicant has enclosed a check in the amount of $246.00 to cover the fee for adding additional claims. If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,
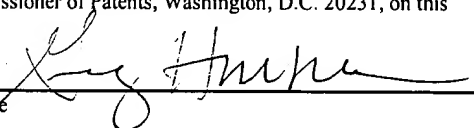
YOUFENG WU ET AL.

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. Box 2938
Minneapolis, MN 55402
(612) 373-6971

Date 4 FEB 2003   By _____
                              J/Michael Anglin
                              Reg. No. 24,916

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this ___4th___ day of February, 2003.

GREG HANSON
Name _____   Signature _____